

The exhibition has been exceedingly successful from an educational point of view, and the exhibits showed that the schools which contributed had entered into the spirit which guided the committee in the preparation of its prospectus and in the desire to demonstrate what nature-study really is.

The judges were Miss Hodgson, formerly of the House of Education, Ambleside; Mr. Jonas Bradley, famous for his outdoor school at Haworth, Prof. Haddon, Prof. Minchin, and Dr. Chalmers Mitchell. The awards were made in strict accord with the objects of the committee, and were given so as to mark the work of the schools which are on the right lines. Certificates of merit, the highest official award of the committee, fell to the lot of the Froebel Institute, Streatham High School, Dulwich High School, Queenswood School, Orlestone Board School, and the Training College for the Deaf, Fitzroy Square.

Not the least important part of the proceedings were the conferences, at which practical teachers not only described their methods, but also in some cases showed how they came to adopt them. Speakers were carefully chosen from among those who exhibited last year and whose work was well known to the executive committee, of which several members helped to organise the previous effort.

On the morning of Saturday Mr. Hedger Wallace, chairman of the executive, presided over a meeting at which Mr. Badley, of Bedales School, Mr. Harry Lowerison, of the Ruskin School Home, Miss Sillham, of the Froebel Institute, and Miss Ethel Webb, of Streatham High School, spoke. In the afternoon the chair was taken by Mr. Jesse Collings, who had something to say about the Bill which he has before Parliament to promote nature-study in elementary schools, more particularly with the view of improving our agricultural education. There is every hope, moreover, that his measure will be passed without opposition. During the afternoon Miss Alderton, of Stretton, Mr. Thomas, of Orlestone, and Mr. Dodgeon, of Burnley, described their work. In the evening Mr. Richard Kearton, who has done so much to change the taking of birds' eggs for the collection to the taking of them by the camera, showed the pick of his well-known studies of wild-life, and others that had not been seen on a screen before. Afterwards, as on the previous evening, Mr. Martin Duncan proved the great possibilities of the Urban Duncan microscope for recording natural history observations in the ordinary way and under the microscope.

On Monday Mr. Oliver G. Pike gave an illustrated lecture on birds in their homes, and later the Middlesex Field Club held a meeting. Mr. Hedger Wallace pointed out the great necessity for a field club which should deal with Middlesex, record the fast disappearing animals and plants, and organise a local museum. Mr. Henry Stevens showed a number of remarkable slides of animals and plants under control, and Mr. Wilfred Webb demonstrated, also by the aid of the lantern (kindly lent by the Royal Geographical Society), how much nature-study could be done in London, proceeding afterwards to touch on the work of schools throughout the country.

On Tuesday evening Mr. R. B. Lodge lectured on some suburban birds and beasts, while under the auspices of the Selborne Society Prof. Boulger and Mr. E. A. Martin spoke on subjects in character with the objects of the exhibition. Financially, also, the exhibition has been a success.

BOTANY AT THE BRITISH ASSOCIATION.

THE meetings of the botanical section at Southport showed no falling off in interest. The arrangements made by the local authorities were admirable, and there was a good attendance of British and foreign botanists.

In his presidential address, Mr. A. C. Seward, F.R.S., gave an able and comprehensive summary of the present state of our knowledge concerning the composition and distribution of the floras of the past, from the earliest records in the Devonian and Lower Carboniferous up to the dawn of the Cretaceous period.

The report of the joint committee of Sections K and L on the teaching of botany in schools was read and dis-

cussed. A summary of the recommendations will be found in the report of the education section. In an interesting discussion which followed the reading of the report in Section K, several botanists expressed their approval of the report, and it was suggested that it would be a good plan if the methods recommended could be tried by teachers and the results communicated to the committee.

The morning of September 11 was given up to a series of papers and a discussion on the subject of heredity. Mr. W. Bateson, F.R.S., in an introductory address on recent discoveries in heredity, gave an excellent account of Mendel's researches, and pointed out that we have now reached a stage at which, by the employment of these methods, the solution of problems in heredity becomes possible under certain conditions. He described many of his own experiments, and exhibited specimens of the results which he had obtained in the hybridisation of various species of plants and animals, all of which give strong support to Mendel's laws.

Miss Edith R. Saunders followed by an extremely lucid account of her recent work on cross-breeding in plants, and showed the results of some of her more striking experiments (*vide Reports to the Royal Society, 1902*).

Mr. C. C. Hurst read a paper on recent experiments in the hybridisation of orchids, in which he showed by means of some beautiful coloured drawings that, so far as the intermediate hybrids are concerned, the results are apparently consistent with Mendelian principles. Dominant hybrids are infertile, and in the case of false hybrids further research is necessary before any definite conclusions can be arrived at.

The morning of September 14 was devoted to a discussion on the origin of the Monocotyledons, introduced by Miss Ethel Sargent, whose work on this subject is well known (*vide "Annals of Botany," 1903*). Miss Sargent maintains that a careful study of the anatomy of seedlings in various families of Monocotyledons and Dicotyledons leads to the conclusion that the common stock from which they both spring was not only angiospermous in character, but that it was more like a Monocotyledon than a Dicotyledon.

Miss E. N. Thomas, who followed with a paper on the structure of the embryo sac and the phenomena of fertilisation, pointed out that the results obtained support Miss Sargent's view in so far as they indicate the existence of a great gulf between Angiosperms and all other groups of plants, whilst there is little, if any, distinction in these respects between Dicotyledons and Monocotyledons.

In the subsequent discussion Miss Sargent's views were freely criticised, but all the speakers agreed that this valuable contribution to a very difficult question opened up a very interesting field of investigation.

Prof. H. Marshall Ward, F.R.S., gave an account, illustrated by plans and lantern slides, of the new botanical laboratories at Cambridge. This large block of buildings provides ample accommodation for study in all departments of botany, and special facilities are afforded for original investigation. The university is to be congratulated upon so important a development of its botanical school. Prof. Lignier presented a paper on the flower of the *Gnetaceæ*, in which some interesting new facts were brought forward, and Dr. Lotsy gave an account of his work on parthenogenesis in *Gnetum ula*.

The semi-popular lecture was given on the afternoon of September 14 by Prof. J. B. Farmer, F.R.S., on stimulus and mechanism in organisation. In a very able address the lecturer discussed the various forms of stimuli and the nature of the processes involved, and endeavoured to trace a connection between the growth and structural differentiation of an organism and the response to definite stimuli acting on special kinds of mechanism.

On September 12 an excursion, under the leadership of Mr. Lomax, was made to the Clough Foot Colliery, and on Tuesday afternoon the vegetation of the sandhills was investigated under the leadership of Dr. Otto v. Darbishire and Mr. Henry Ball. In a paper which he had previously communicated to the section as a preliminary to this excursion, Dr. Darbishire pointed out that the sand dunes are encroaching on the grass land, and that, although they can be fixed by sand-loving plants, it is only temporarily, and psamma is commonly planted for this purpose. The plant societies in the various regions of the dunes are well marked, and include a number of extremely interesting

plants, one of which, *Pyrola rotundifolia*, var. *maritima*, is found in certain parts in great profusion.

Of the numerous other papers communicated to the section, reference can only be made to some of the more important.

Fungi.—Mr. B. T. P. Barker (Cambridge) gave an account of the ascocarp in *Ryparobius*. The ascogonium appears to be uninucleate at first, and immediately after contact with the antheridial branch contains two nuclei, either situated closely together or apparently fusing. Later most of the cells of the system of hyphæ, developed from the ascogonium, are uninucleate, but some contain two nuclei, which probably fuse and become the single nucleus of a young ascus. Associated closely with this single nucleus is a structure of variable shape which has almost as strong an affinity for stains as the chromatin of the nucleus itself. It appears to be of the nature of a vacuole and to be intimately concerned with the nutrition of the nucleus, which at this time is of a remarkably large size. The results obtained point to a close relationship between the genera *Ryparobius* and *Thelebolus*.

Mr. E. S. Salmon communicated the results of culture experiments with biologic forms of the Erysiphaceæ, which prove that under certain conditions a "biologic form" which in nature is restricted to the species of a certain genus of host-plants becomes capable of infecting species belonging to another genus, and species of plants which are immune in nature are able to be infected. The author considers that it is possible that in this change of infection-powers of biologic forms of parasitic fungi in consequence of injury to the host-plant an explanation may be found of the sudden appearance of disease on plants hitherto immune.

Prof. H. Marshall Ward, F.R.S., in a paper on Eriksson's mycoplasma hypothesis, showed by means of a series of microphotographs and drawings that this so-called mycoplasma consists of haustoria only, and that there are no grounds for believing that Eriksson's views are well founded.

Prof. T. Johnson communicated a short note on a willow canker which has been the cause of considerable damage in an osier holt in the west of Ireland.

Physiology.—Prof. Letts and Mr. J. S. Totton contributed a valuable paper on the occurrence of *Ulva latissima* and *Enteromorpha compressa* in sewage effluents, and on variations in the composition of the tissues of these and allied seaweeds. The view expressed by one of the authors in conjunction with another chemist, that the growth of *Ulva latissima* in quantity in a given locality is a sign of sewage pollution, has received remarkable confirmation by the occurrence of this seaweed and of *Enteromorpha compressa* in the Belfast sewage beds. The spores probably found their way into the sewage by leakage of sea water into the system. The percentage of nitrogen was found to be higher, especially in *Enteromorpha*, in the sewage specimens than in those taken from the sea or brackish water.

Mr. R. H. Yapp gave an account of his observations on fruit-dispersal in *Adenostemma viscosum*. This plant is a composite which is widely distributed in the warmer regions of the globe. The distribution of the fruit is brought about by a pappus which consists of stalked glands, composed of numerous capitate hairs, which secrete a copious viscid fluid. The movements of the pappus setæ are effected by a group of motor cells which forms a pulvinus at the base of the stalk of each gland.

Mr. Harold Wager described some experiments on the staminal hairs of *Tradescantia virginica*, from which it appears that the protoplasmic movement can continue for some days after the hairs are removed from the plant, even if they are completely embedded in vaseline. The author also described a method by which the nucleus of the cells can be stained by means of the coloured cap contained in the vacuole.

Mr. J. Parkin gave an account of his work on the localisation of anthocyan in foliage leaves. In young leaves, and in the autumn coloured leaves, the anthocyan is usually confined to the mesophyll; in mature leaves mainly to the epidermis, except when the colouring matter is only produced under exceptional conditions, when it is usually found in the mesophyll. The author concludes that the presence of anthocyan in the mesophyll seems to weaken somewhat the view that its function is to protect the chlorophyll by absorbing the destructive solar rays.

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Anatomy and Cytology.—Miss Ethel Sargant and Miss Aenes Robertson read a paper on some anatomical features of the scutellum of *Zea Mais*. They find that the epithelium of the scutellum in contact with the endosperm becomes folded into a number of gland-like structures in which traces of some kind of secretion are commonly found.

Mr. Arthur W. Hill (Cambridge), in a paper on the histology of the sieve tubes of Angiosperms, showed that the sieve plates of the mature sieve tubes are traversed by relatively thick slime strings, each being enclosed in a callus rod. In the radial and tangential walls the slime strings, which are grouped into oval or rounded pitted areas, are much smaller than those in the sieve plates, and some three to six strings are enclosed in a callus rod. Connecting threads also occur between the sieve tubes and companion cells. Between the sieve tubes and cambiform cells, and between the latter and the companion cells, the small groups of threads are found in small and deep pits.

Mr. J. Lloyd Williams (Bangor) read a paper on the alternation of generations in the Dictyotaceæ and the cytology of the asexual generation, in which he pointed out that the nuclei of the tetraspore plants have about thirty-two chromosomes, and that in the formation of the tetraspores these become reduced to sixteen. The sexual plants also have the reduced number. The evidence, therefore, shows that the tetraspore produces a sexual plant, whilst the oospore produces the tetraspore generation.

Mr. L. A. Boodle (London) communicated a short paper on the structure of leaves of bracken from different habitats. In a very exposed and sunny situation the leaves are hard and short, while in a well sheltered and shaded locality they are much larger and soft. Long sori and short sori are typical of the first and second situation respectively. The internal structure of the pinnules varies with the habitat in a corresponding manner; the presence of a continuous, or nearly continuous, hypoderm and the large amount of the palisade tissue formed distinguish the leaf of the exposed from that of the sheltered plant.

Ecology, Distribution, &c.—In addition to Dr. Darbishire's paper on the sandhills of Southport, several other papers of some interest were read in this section. Miss M. C. Stopes gave an account of the colonisation of a dried river-bed. The stream became dried up in April, 1901, and during the years 1901–1903 observations were made upon the plants found growing on the dried up mud. In 1903 these included eleven frequent semi-aquatics, of which four are locally dominant, and thirty-two frequent land plants, of which eight are locally dominant.

Mr. T. W. Woodhead (Huddersfield) described his methods of mapping the distribution of plants, and the anatomical variations produced in the leaves of certain plants grown under varying conditions in different plant societies. He showed clearly by means of photographs what striking variations may be produced in the undergrowth of a wood owing to the nature of the trees immediately above it.

Dr. F. F. Blackman (Cambridge) gave an excellent summary of modern views on the phylogeny of the Algæ, illustrated by diagrams.

Mr. A. W. Hill (Cambridge) gave an account of his recent expedition to Upper Peru, and Mr. W. Wilson communicated a list of some of the plants growing on the serpentine rocks of the north-east of Scotland.

Fossil Plants.—There were only two papers of any importance in this section. Mr. E. A. Newell Arber (Cambridge) communicated some interesting observations on homeomorphy among fossil plants. Among recent plants species of different descent may possess many closely identical characters as the result of adaptation to particular conditions of the environment. There is some reason to believe that similar cases may be found among fossil plants, and the author finds some ten genera and species in which this phenomenon occurs.

Mr. Seward communicated a paper by Dr. D. H. Scott, F.R.S., and Prof. F. W. Oliver on the seed of *Lyginodendron*, which was illustrated by some beautiful lantern slides.

Economic Botany.—Mr. E. T. Scammell read a paper on the forest resources of Australia available for British commerce. The forest areas of Australia comprise 107,037,000 acres of marketable timber, or nearly half the areas of the forest lands of Europe, excluding Russia. The timbers are

of many varieties, and some of them are of high commercial value. The chief of these are the eucalypts, of which there are more than 150 species. Besides the eucalypts there are many kinds of casuarinas (the Australian oak), some conifers (the Moreton Bay pine, the cypress pine, the brown pine, or colonial deal, and others), many acacias (the Australian wattle), Banksias, and numerous other varieties. The range of Australian wood at present available for British commerce is limited. Western Australia and Tasmania are the only States that have seriously dealt with the question of exporting timber or of using their forest resources as a valuable commercial asset.

Mr. W. Powell described a process for seasoning and preserving timber which appears to be at once simple and effective. The timber is treated with a dilute solution of sugar, in which it is boiled until the air in the interstices has been got rid of. The timber is then cooled and dried at a fairly high temperature. Timber treated in this way is much improved, the soft woods especially, both in hardness and toughness.

EDUCATION AT THE BRITISH ASSOCIATION.

THE educational science section has become the debating ground where educational principles can be discussed without reference to minor administrative details and class distinctions. Increased efficiency is the leading idea, and it is promoted by the expression of authoritative opinion from a platform of the British Association. Attention is there directed to matters requiring consideration by authorities responsible for educational work, and the directions in which progress can be most usefully made are afterwards indicated in reports presented by committees. The work of the section is thus both critical and constructive, and its sphere of influence increases in extent every year.

After the president's address on the morning of September 10, a discussion on school curricula was carried on throughout that day and the next. The material for discussion consisted of eight papers received from leading representatives of various branches of educational work in response to an invitation issued by the committee of the section. The papers were printed in full in the September number of the *School World*, and the authors are Prof. J. Adams, Prof. H. E. Armstrong, F.R.S., Miss S. A. Burstall, Mr. G. F. Daniell, Mr. W. C. Fletcher, Mr. T. E. Page, Mr. J. L. Paton, and Prof. Michael E. Sadler. The three main divisions of the subject were:—(1) General principles upon which a school curriculum should be constructed; (2) the education of girls; (3) commercial education. To concentrate attention upon specific points, several propositions were formulated, and the authors of the papers were asked to speak to them instead of reading the papers. The propositions which were laid before the meeting during the discussion, and received general assent, were as follows:—

(1) It is desirable that specialisation should be deferred to as late a period as possible in the school career, and that the early curriculum should be so arranged as to lay a good foundation in English subjects, with, say, drawing and elementary science.

(2) It is to be regretted that the influence of public school entrance and scholarship examinations encourages the premature devotion of too much time to classics; it would be desirable that the study of Latin should not be taken before, say, twelve years of age, and that the language teaching up to that time should be confined to the mother tongue and one modern language.

(3) That a large measure of practical instruction should be included in the school course, and that both literary and practical instruction should be given throughout and made interdependent.

(4) It is desirable that in organising the curriculum there should be some differentiation, especially in science, between courses of study for boys and those for girls, more particularly between twelve and sixteen years of age.

(5) That for all girls literary instruction is of the highest importance; at some period of their school life practical instruction in the domestic arts should be provided, based on and correlated with elementary science teaching.

(6) With the view of obviating over-pressure, injury to

health and superficiality, girls who intend to proceed to college, or enter a literary profession, should in general remain at school until eighteen years of age.

(7) It is desirable that county and borough councils and other authorities offering scholarships for girls to enable them to proceed to college should not expect them to take up their scholarships before they reach the age of eighteen.

It is impossible to describe in a few words the many important opinions expressed in the papers and during the discussion, but there was general agreement that the development of intelligence and self-reliance is of prime importance. The discipline of scientific studies was generally recognised, and also the necessity of making courses of instruction more practical than hitherto; that is to say, pupils should be active rather than passive in their attitude towards knowledge.

This is the touchstone which will test the quality of all educational work, whether in the humanities or in science, but as science deals with things more than words, it has special claims for recognition in the school curriculum. Mr. Balfour a short time ago, in referring to the relative advantages of classics and science as school subjects, expressed himself as doubtful whether scientific studies could supersede with advantage the traditional course of classics in schools. In connection with his remarks, it is of interest to refer to the following statement made by Mr. A. C. Benson in the *School World* for October in continuation of the discussion on curriculum:—"I have taught classics at Eton for nearly twenty years to boys of every degree of capacity. I have found that as a basis for teaching able boys they are excellent. But the effect of the present crowded curriculum, with classics as the basis, upon boys of ordinary or limited capacity is so absolutely negative, from the educational point of view, that I should hold that it would justify almost any experiment being tried."

Here we have an acknowledgment by a teacher of exceptional experience and ability of the failure of classical instruction so far as the average boy is concerned. This in itself is sufficient to justify the plea of the reformer for a readjustment of school studies on a broader basis than that at present adopted. In the discussion on curriculum, Mr. T. E. Page, a representative of literary culture, asked what branch of natural knowledge men of science wished to be taught in schools, and urged that there was a diversity of opinion upon this matter. The answer is, of course, that the subject is not so important as the method. It matters little whether botany, physics, chemistry, or any other science subject is used as the basis of instruction provided that they are studied practically under encouraging conditions and in the spirit of scientific inquiry. What men of science urge is that scientific studies are capable of forming habits of mind—resourcefulness, perspicacity, enterprise and initiative—in a way which the traditional courses and methods have not accomplished in the past.

A general view of the work done by the late Dr. Gladstone in connection with the teaching of science in elementary schools is contained in the final report of the committee on that subject. The committee was first appointed in 1878, with Mr. Mundella as chairman and Dr. Gladstone as secretary, and since 1883 has been annually reappointed to continue inquiries on the subject then instituted. The chief work of the committee has been to watch and record the proportion of children examined in science subjects in elementary schools. There has, of course, been a decided increase in numbers, but when the character of the work which has been done is considered, the committee now reports that the progress made is undoubtedly unsatisfactory. It is beyond question that science has in no way taken its proper place in our system of elementary education. Here and there work of the very greatest value has been done, but such cases are all too rare.

The report concludes with the remark that, in view of the national importance of developing the scientific spirit in elementary schools, it is not too much to say that it is now the duty of the Association to intervene with constructive proposals which will promote such an object. Judging from the great success which has attended the labours of the committee on the teaching of chemistry in schools and the recent discussion on the teaching of mathematics, there can be little doubt that a general inquiry might now be undertaken with great advantage, and that proposals might be made which would be of the greatest value